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09/900,565	07/06/2001	Kevin E. Spaulding	82921RLO	4100

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EXAMINER	
YANG, RYAN R	

ART UNIT	PAPER NUMBER
2672	8

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 09/900,565	Applicant(s) SPAULDING ET AL.	
	Examiner Ryan R Yang	Art Unit 2672	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *08 December 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *17* is/are allowed.

6)☒ Claim(s) *1-16 and 18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. This action is responsive to communications: Amendment, filed on 12/8/2003. This action is final.

2. Claims 1-18 are pending in this application. Claims 1, 14 and 17 are independent claims. In the Amendment, filed on 12/8/2003, claims 1-5, 13, 14 and 17 were amended.

3. The present title of the invention is "Method for representing a digital color image using a set of palette colors" as filed originally.

Claim Rejections - 35 USC § 112

4. Claims 1, 14 and 17 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The amended claim limitations claim the regions of important colors are pre-defined, however, there is no mentioning in the specification that the regions of important colors are pre-defined.

Claims 2-13, 15-16 and 18 are rejected because they are dependent on rejected claims.

Claim Rejections - 35 USC § 102

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 14-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Balasubramanian et al. (Journal of Imaging Technology, 1991).

7. As per claim 14, Balasubramanian disclose a method for converting an input digital color image having a set of possible input colors to an output digital color image having a set of palette colors, the number of palette colors being less than the number of possible input colors, wherein the set of palette colors is determined based on the distribution of colors in the first digital image supplemented by a distribution of important colors, comprising the steps of:

a) appending additional pixels to the input digital color image to form an enlarged input digital color image, where the color of the additional pixels is distributed according to the distribution of important colors ("when merging two clusters, their two color lists were simply appended. When all merging was completed, each distinct color in the histogram was assigned an output palette color, which was the centroid of the cluster where the input color belonged. Finally, an array of pointers was used to map each pixel location to the appropriate node in the histogram", page 286, third paragraph, line 7-13, where each cluster is a boosted distribution of colors in an image region);

b) determining the distribution of colors in the enlarged input digital color image ("when merging two clusters, their two color lists were simply appended. When all merging was completed, each distinct color in the histogram was assigned an output

palette color", page 286, third paragraph, line 7-13, where each cluster is a boosted distribution of colors in an image region);

c) determining the set of palette colors to be used in the formation of the output digital color image responsive to the distribution of colors in the enlarged input digital color image ("when merging two clusters, their two color lists were simply appended. When all merging was completed, each distinct color in the histogram was assigned an output palette color", page 286, third paragraph, line 7-13, where each cluster is a boosted distribution of colors in an image region); and

d) forming the output digital color image by assigning each color in the input digital color image to one of the colors in the set of palette colors ("When all merging was completed, each distinct color in the histogram was assigned an output palette color", page 286, third paragraph, line 7-13).

8. As per claim 15, Balasubramanian demonstrated all the elements as applied to the rejection of independent claim 14, supra, and Balasubramanian further discloses the additional pixels are provided in the form of a predetermined target image (where each of the merged cluster region is color from added pixel region).

Claim Rejections - 35 USC § 103

9. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

10. Claims 1-5, 9-10, 13, 16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Balasubramanian et al. and further in view of Czako (6,229,523).

11. As per claim 1, Balasubramanian et al., hereinafter Balasubramanian, discloses a method for converting an input digital color image having a set of possible input colors to an output digital color image having a set of palette colors, the number of palette colors being less than the number of possible input colors, wherein the set of palette colors is determined based on the distribution of colors in the input digital image supplemented by a distribution of pre-defined important colors, comprising the steps of:

a) determining the distribution of colors in the input digital color image ("we assigned a local activity index α_k ... It was necessary to define a composite activity measure ... Colors were then categorized as belonging to one of three classes: a low, medium, or high activity class, by comparing their composite activity measures to two experimentally determined thresholds ...", page 286, column 2, line 20-49, distribution of colors is determined by categorizing);

d) forming the output digital color image by assigning each color in the input digital color image to one of the colors in the set of palette colors ("For a given test image, high values were initially chosen for t_1 and t_2 (i.e., most colors were finely prequantized), the image was quantized to 256 colors using the PNN algorithm", page 287, second paragraph).

Balasubramanian discloses a method for converting an input digital color image having a set of possible input colors to an output digital color image having a set of lesser palette colors. It is noted that Balasubramanian does not explicitly disclose supplementing the distribution of colors in the input digital color image by a distribution of pre-defined important colors; and determining the set of palette colors to be used in

the formation of the output digital color image responsive to the supplemented distribution of colors, however, this is known in the art as taught by Czako. Czako discloses a display processor in which b) supplementing the distribution of colors in the input digital color image by a distribution of pre-defined important colors ("a display processor includes a color palette", column 4, line 26);

c) determining the set of palette colors to be used in the formation of the output digital color image responsive to the supplemented distribution of colors ("a color palette that supports more than the four color/contrast values pre-defined fir DVD system ...", column 4, line 30-35, where Emphasis 1 and Emphasis 2 are the supplemented distribution of colors).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Czako into Balasubramanian because Balasubramanian discloses a method for converting an input digital color image having a set of possible input colors to an output digital color image and Czako disclose the color palette can be supplemented with emphasis colors in order to highlight a desirable portion of an image.

12. As per claim 2, Balasubramanian and Czako demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Balasubramanian further discloses the regions of pre-defined important colors includes regions of skin-tone colors ("the quantization was kept fine in smooth areas such as the shoulder and cheeks", page 289, first paragraph, where it is inherent that shoulder and cheeks are regions of skin-tone).

It is noted that Balasubramanian does not explicitly disclose pre-defined important colors includes regions of skin-tone colors, however, since Balasubramanian recognizes a region of important color by redefining the size of quantization cell, it is would have been obvious to one of ordinary skill in the art to pick a region as a region of important colors in order to emphasize those colors in an image.

13. As per claim 3, Balasubramanian and Czako demonstrated all the elements as applied to the rejection of independent claim 1, supra.

As for the distribution of pre-defined important colors includes a distribution of neutral colors, since Balasubramanian discloses "the quantization was kept fine in smooth areas", page 289, first paragraph, it would have been obvious to one of ordinary skill in the art to consider regions of neutral colors as regions of important colors in order to make the region look more natural.

14. As per claim 4, Balasubramanian and Czako demonstrated all the elements as applied to the rejection of independent claim 1, supra.

As for the distribution of pre-defined important colors includes distribution of sky colors, since Balasubramanian discloses "the quantization was kept fine in smooth areas", page 289, first paragraph, it would have been obvious to one of ordinary skill in the art to consider regions of sky colors as regions of important colors in order to make the region look more natural.

15. As per claim 5, Balasubramanian and Czako demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Balasubramanian further discloses determining the supplemented distribution of colors is accomplished by

appending additional pixels to the input digital color image to form an enlarged input digital color image, where the color of the additional pixels is distributed according to the distribution of pre-defined important colors, and then determining the distribution of colors in the enlarged input digital color image ("when merging two clusters, their two color lists were simply appended. **When all merging was completed, each distinct color in the histogram was assigned an output palette color**, which was the centroid of the cluster where the input color belonged. Finally, an array of pointers was used to map each pixel location to the appropriate node in the histogram", page 286, third paragraph, line 7-13, where each cluster is a boosted distribution of colors in an image region).

16. As per claim 9, Balasubramanian and Czako demonstrated all the elements as applied to the rejection of independent claim 1, supra, Balasubramanian and further discloses the set of palette colors is determined using a vector quantization algorithm ("The basic algorithm is an application of Equitz's clustering VQ technique ...", page 284, column 2, line 30).

17. As per claim 10, Balasubramanian and Czako demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Balasubramanian further discloses the output digital color image is formed by assigning each color in the input digital color image to the color in the set of palette colors having the smallest color difference relative to the color of the input digital color image ("the prequantization step should assign smaller quantization cells in RGB space to colors with low activity measures and larger cells to high activity colors ... Two colors would be assigned to the

same cell if they belong to the same activity category corresponding to cell length *l*', page 286, column 2, last paragraph- page 287, column 1, line 6, the color falling within that color cell has minimum error according to that cell).

18. As per claim 13, Balasubramanian and Czako demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Balasubramanian further discloses the distribution of pre-defined important colors is only used to supplement the distribution of colors in the input digital color image in color regions where the input digital color image contains a significant number of pixels (a typical image is 512x512 pixels, page 286, column 1, last line).

19. As per claim 16, Balasubramanian demonstrated all the elements as applied to the rejection of independent claim 1, supra.

As for the target image is resized to match the size of the input digital color image, it would have been obvious to one of ordinary skill in the art to match the size of the out image to the input image in order to retain the same viewing size.

20. As per claim 18, Balasubramanian demonstrated all the elements as applied to the rejection of independent claim 1, supra.

As for a computer storage medium having instructions stored therein for causing the computer to perform the method of claim 1, since Balasubramanian's is about digital image displayable on a computer monitor, it would have been obvious for Balasubramanian to use a computer with storage medium to store instructions to perform such task on a computer.

21. Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Balasubramanian et al. as applied to claim 1 above, and further in view of Balasubramanian et al. (5,432,893).

22. As per claim 6, Balasubramanian demonstrated all the elements as applied to the rejection of independent claim 1, supra.

Balasubramanian discloses a method of converting an input digital color image having a set of possible input colors to an output digital color image having a set of palette colors. It is noted that Balasubramanian does not explicitly disclose using a sequential scalar quantization algorithm to determine a set of palette colors, however, this is known in the art as taught by Balasubramanian et al. (5,432,893), hereinafter Balasubramanian (5,432,893). Balasubramanian discloses a method of determining a set of palette colors using sequential scalar quantization algorithm (column 6, line 5-18).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Balasubramanian (5,432,893) into Balasubramanian because Balasubramanian discloses a method of converting an input digital color to an output digital color having a limited set of palette colors and Balasubramanian (5,432,893) discloses the quantizing process can be performed by sequential scalar quantization algorithm in order to achieve it in an optimum and highly efficient manner, column 6, line 15.

23. As per claim 7, Balasubramanian demonstrated all the elements as applied to the rejection of dependent claim 6, supra, and Balasubramanian (5,432,893) further disclose the sequential scalar quantization algorithm includes the steps of:

i) sequentially partitioning the colors of the supplemented distribution of colors into a set of color space regions ("sequentially partitioning said asymptotically optimal quantizer density chrominance and luminance axes through which said histogram is defined into a plurality of histogram cells", column 31, line 43-47); and

ii) determining the set of palette colors by selecting an output color for each color space region in the set of color space regions ("for each of said histogram cells, deriving a respective set of chrominance and luminance output codes", column 31, line 48-50).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Balasubramanian (5,432,893) into Balasubramanian because Balasubramanian discloses a method of converting an input digital color to an output digital color having a limited set of palette colors and Balasubramanian (5,432,893) discloses the quantizing process can be performed by sequential scalar quantization algorithm in order to achieve it in an optimum and highly efficient manner, column 6, line 15.

24. As per claim 8, Balasubramanian demonstrated all the elements as applied to the rejection of dependent claim 7, supra, and Balasubramanian (5,432,893) further discloses determining the color value for each pixel of the output digital color image by identifying the palette color corresponding to the color space region containing the input color for the corresponding pixel of the input digital color image ("The output map spatially associates each of the pixels of the image array with one of the numerical values of the respective YCC cells of the histogram ... so that an output image

displayed thereby will faithfully replicate the color content of the original digital image", column 18, line 63- column 19, line 9).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Balasubramanian (5,432,893) into Balasubramanian because Balasubramanian discloses a method of converting an input digital color to an output digital color having a limited set of palette colors and Balasubramanian (5,432,893) discloses the quantizing process can be performed by sequential scalar quantization algorithm in order to achieve it in an optimum and highly efficient manner, column 6, line 15.

25. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Balasubramanian et al. as applied to claim 1 above, and further in view of Gentile et al. (Journal of Optical Society of America, 1990)

26. As per claim 11, Balasubramanian demonstrated all the elements as applied to the rejection of independent claim 1, supra.

Balasubramanian discloses a method of converting an input digital color image having a set of possible input colors to an output digital color image having a set of palette colors. It is noted that Balasubramanian does not explicitly disclose step d) includes the use of a multi-level halftoning technique to assign each color in the input digital color image to one of the colors in the set of palette colors in such a way so as to approximately preserve the local mean color value, however, this is known in the art as taught by Gentile et al., hereinafter Gentile. Gentile discloses a method of quantizing color images using multi-level halftoning technique (see title).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Gentile into Balasubramanian because Balasubramanian discloses a method of converting input digital color image into output digital image with limited colors and Gentile discloses a method of quantizing the colors in order to achieve near-original image quality.

27. As per claim 12, Balasubramanian and Gentile demonstrated all the elements as applied to the rejection of dependent claim 11, supra, and Gentile discloses the multi-level halftoning technique is an error diffusion technique that distributes the quantization errors introduced when processing an input pixel to nearby input pixels that have not yet been processed (page 1019, column 2, line 10-11).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Gentile into Balasubramanian because Balasubramanian discloses a method of converting input digital color image into output digital image with limited colors and Gentile discloses a method of quantizing the colors in order to achieve near-original image quality.

Allowable Subject Matter

28. Claim 17 is allowed.

The following is a statement of reasons for the indication of allowable subject matter:

As per claim 17, the closest prior art by Balasubramanian does not explicitly disclose the step e) forming an output digital color image by removing the additional

pixels from the enlarged output digital color image in converting an input digital color image having a set of possible input colors to an output digital color image having a set of palette colors.

Response to Arguments

29. Applicant's arguments with respect to claims 1-13 have been considered but are moot in view of the new ground(s) of rejection.

Re claims 14-15, applicant alleges Balasubramanian does not disclose appending the pre-defined important colors. In reply, examiner notes that since the steps Balasubramanian teach are prequantization step (page 286, column 2, line 14), therefore, the important colors are pre-defined.

Re applicant argues Balasubramanian does not disclose appending additional pixels to the input digital image. In reply, examiner notes the steps of merging two clusters, their two color lists were simply appended (page 286, column 1, third paragraph). A cluster is defined as a vector (page 285, paragraph 2, line 5). The merging process of clusters occurs when the image was passed through a variable-size cubical quantizer (see Abstract). Therefore, the process of passing the image to a quantizer is inherently a process of adding pixels to the processed image.

Conclusion

32. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

33. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Inquiries

34. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Ryan Yang** whose telephone number is **(703) 308-6133**.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Michael Razavi**, can be reached at **(703) 305-4713**.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9314 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 305-47000377.

Ryan Yang
February 22, 2004

Jeffery A. Brier
JEFFERY BRIER
PRIMARY EXAMINER